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Temporal Trend in the Methods of Suicide in Kathmandu District: A Descriptive Study

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ABSTRACT

Introduction

Suicide is one of the major causes of death in Nepal. This study examines trends in suicide methods in Kathmandu, Nepal. The study aims to understand suicidal method changes over time and guide effective prevention strategies.

Methods

This study is descriptive study of autopsy data from the Department of Forensic Medicine at Maharajgunj Medical Campus, Kathmandu from January 2013 to December 2022. Linear regression analyzed changes in suicide rates by gender and method over time. Chi-square tests assessed monthly frequency deviations. Data was stratified by age groups and sex to identify any potential correlations between these variables and the methods of suicide used.

Results

Among 2,513 males suicide, the most common method was hanging accounting for 1,633 (64.98%) cases, followed by self-poisoning at 806(32.07%) cases, with falls and self-immolation each at 1.31%. For 1,905 females suicide, hanging remained the most prevalent method with 1,215 (63.77%) cases, followed by self-poisoning at 622 (32.65%) cases, with falls (0.57%) and self-immolation (2.78%) being less common. The mean age for male suicides was 37.15(SD=15.83), while for females it was 30.94 (SD=14.20), indicating a difference of 6.21 years. Suicide rates peaked in summer (July-August) with 450 cases and dropped in winter (December-February) at 309 cases.

Conclusion

Hanging was the most common method of suicide across all age groups, though its prevalence declined with age. In contrast, self-poisoning became more common as age increased. The study depicted that females tend to commit suicide at relatively younger age than males. Significant seasonal variations in suicide rates were observed.

Keywords
Autopsy; forensic; hanging; suicide rate; trend

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INTRODUCTION

Suicide is potentially self-injurious behavior associated with expressed or implied intent to die.[1] Suicide remains a critical global health issue, with 703,000 deaths annually contributing 1.3% of all deaths.[2] In 2012, Nepal was ranked 7th globally for its estimated age-standardized suicide rate of 24.9 per 100,000 by WHO. Its prevalence and methods vary across different regions and time periods. Suicide methods are influenced by factors such as the accessibility and availability of certain means, socio-cultural and religious norms, the method's popularity in a specific area, and individual circumstances.[3–6]

Suicide methods are broadly categorized into "violent" and "non-violent" methods. Violent methods include hanging, jumping from heights, self-immolation, firearms, sharp object injuries, and jumping in front of moving objects. Non-violent methods include self-poisoning, drowning, and less common methods such as exposure to hot vapors, blunt object injuries, etc.[3] Hanging is the most common method worldwide and in Nepal followed by self-poisoning.[6–12] Less common methods used in Nepal include self-immolation, drowning, jumping, and sharp weapon injuries.[12]

Research on changes in suicide methods over time in Nepal is scarce. The study aims to identify and analyze trends in suicide methods, including age and gender correlations.

METHODS

This study used a descriptive design to analyze temporal trends in suicide methods using autopsy data from the forensic records of Department of Forensic Medicine(DoFM) at Maharajgunj Medical Campus (MMC), Kathmandu, Nepal, from 1st January 2013 to 31st December 2022. The data was systematically collected and organized using Microsoft Excel version 19. For the statistical analysis, we utilized the SPSS version 20, incorporating descriptive statistics, frequency distributions, and inferential statistics.

The data for the background population was collected from the national statistics office in Nepal, from which the population of Kathmandu district in year 2011 and 2021 was collected, including the male and female population.[13] Due to the unavailability of population data for each year, which was required for our study, the population for each year from 2011 to 2022 was projected using 1.51% as the growth rate per annum. The weighted-mean sex ratio was calculated considering the sex-ratio of 2011 to be 109.84 and 2021 to be 102.97 from census data.[14]

To assess the significance of deviations between observed and expected suicide frequencies across different months, Chi-square tests were applied. A linear regression model was employed to analyze changes in suicide rates over time, stratified by gender and methods of suicide. A linear regression model was used instead of a negative binomial regression model since the primary interest was in analyzing continuous trends in suicide rates over time rather than counting data with overdispersion.[15] Significance levels for all tests were set at $p<0.05$. The autopsy data were handled ensuring strict confidentiality and data protection throughout the research process. A formal ethical approval was obtained from Institutional Review Committee of Institute of Medicine for the research.

RESULTS

A total of 4418 suicides were reported from autopsy data, during the studied duration of 10-year. Among them, 2513 (56.88%) were males and 1905 (43.11%) were females. The mean age at death for males was 37.15 [Standard deviation(SD) = 15.83 and Range = 9-87] whereas the mean age at death for females was 30.94 [SD= 14.20 and range = 8-96]. Frequency of suicide by age for both sexes are depicted in Figures 1 and 2. Females were significantly younger than males at the time of suicide ($p<0.001$), and the mean difference in age was 6.21.

As depicted by Figure 3, the overall annual suicide rate increased by 0.74% from 22.71 per 100,000 in 2013 to 22.54 per 100,000 in 2022. Specifically, the female suicide rate decreased by 28.75%, from 23.51 to 16.75 per 100,000, while the male suicide rate increased by 27.57%, from 21.94 to 27.99 per 100,000.

The linear regression analysis indicated an overall annual increase in the suicide rate of 0.173% per year ($p = 0.59$). For males, the suicide rate increased by 0.614% per year ($p = 0.08$), whereas for females, it decreased by 0.294% per year ($p = 0.43$).

The data on the overall gender distribution of suicide methods revealed distinct patterns between males and females (Table 1). Among the 2,513 male suicides, hanging was the most prevalent method, accounting for 1633 (64.98%) of cases. Self-poisoning was the second most common method, used in 806 (32.07%) of male suicides. Less common methods included falls and self-immolation, each representing 1.31%, while drowning (0.11%), gunshots (0.15%), and stabbing (0.039%) were relatively rare.

For the 1,905 female suicides, hanging was similarly the most common method, making up 1215 (63.77%) of cases, closely followed by self-poisoning at 622 (32.65%). Other methods were less frequently employed, with falls accounting for 0.57% and self-immolation for 2.78%. Drowning was slightly more common among females than

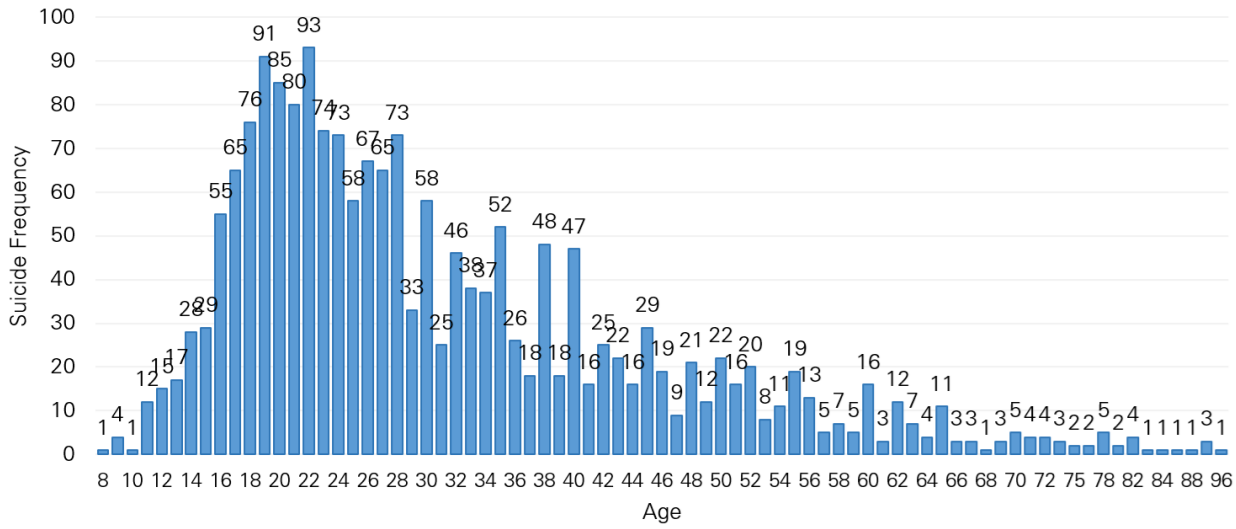

Figure 1. Bar diagram showing distribution of suicide in male population according to age

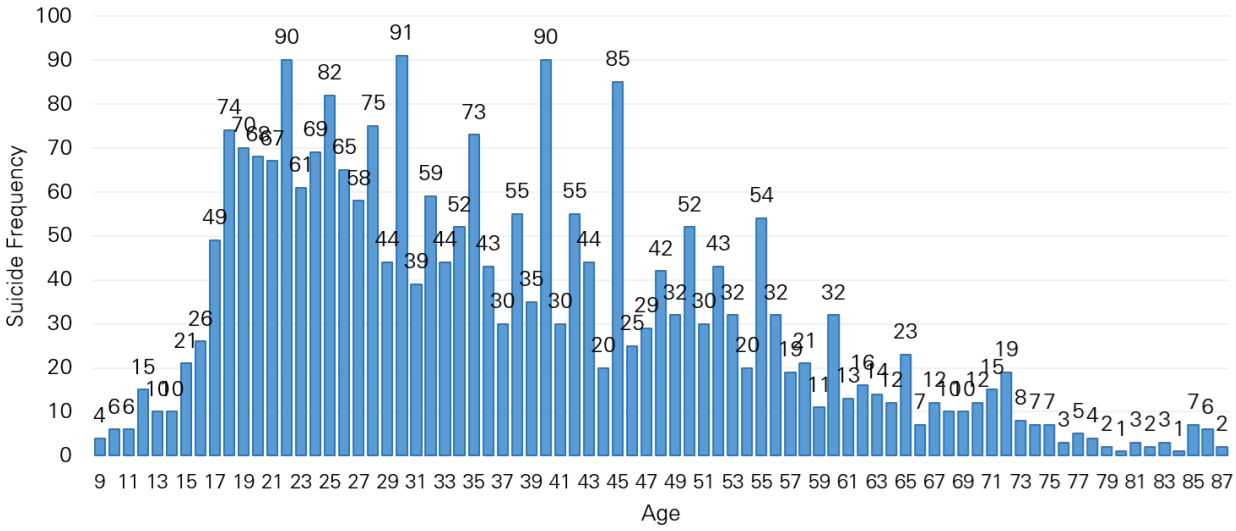

Figure 2. Bar diagram showing distribution of suicide in female population according to age

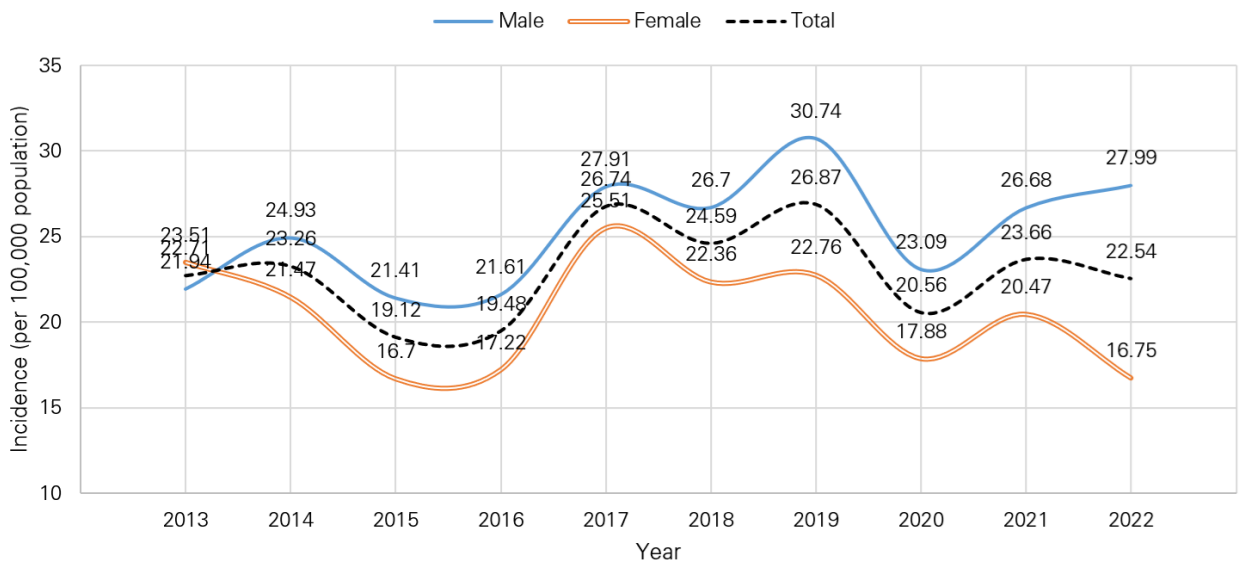

Figure 3. Line graph showing the incidence of suicide over the years

Table 1. Absolute number and percentage of suicide by age, sex and suicide methods, from 2013-2022

Suicide Methods	Age group (years)							
	0-14		15-29		30-59		60 and above	
	Male	Female	Male	Female	Male	Female	Male	Female
Hanging	40 (80.0)	72 (92.3)	698 (75.95)	704 (69.22)	769 (59.70)	386 (54.51)	126 (49.21)	53 (51.96)
Self-Poisoning	10 (20.0)	6 (7.6)	185 (20.13)	273 (26.84)	486 (37.73)	298 (42.09)	125 (48.82)	45 (44.11)
Fall	-	-	11 (1.19)	8 (0.78)	19 (1.47)	1 (0.14)	3 (1.17)	2 (1.96)
Self-immolation	-	-	20 (2.17)	30 (2.94)	13 (1.00)	21 (2.96)	-	2 (1.96)
Drowning	-	-	2 (0.21)	2 (0.19)	-	2 (0.28)	1 (0.39)	-
Gunshot	-	-	2 (0.21)	-	1 (0.07)	-	1 (0.39)	-
Stab	-	-	1 (0.10)	-	-	-	-	-

males, at 0.20%, while gunshot and stabbing were absent or negligible as methods used by females.

We divided our population pool of suicide into four primary age groups 0-14, 15-29, 30-59, and 60 above. Similar division of age group was done in a suicide study from 1995 to 2019 in Denmark, trying to explore the variation in suicidal data in teens, early adulthood, late adulthood and elderly population.[3] The above study data presents the distribution of suicide methods across different age groups, with

Table 2. Changes in suicide methods over time (2013-2022) (per 1,00,000 population)

Year	Sex	Suicide methods						
		Hanging	Self-Poisoning	Fall	Self-immolation	Drowning	Gunshot	Stab
2013	Male	13.51	7.99	0.32	0.11	-	-	-
	Female	15.48	7.34	0	0.69			
	Total	14.46	7.67	0.17	0.39			
2014	Male	15.97	8.41	0.11	0.53	-	-	-
	Female	11.86	8.47	0.23	0.79			
	Total	13.98	8.44	0.16	0.66			
2015	Male	13.11	12.48	0.31	0.31	0	0.10	-
	Female	10.79	5.23	0.11	0.45	0.11	0	
	Total	11.99	6.42	0.22	0.38	0.05	0.05	
2016	Male	13.64	7.33	0.310	0.10	0.10	0.10	-
	Female	10.63	5.81	0.109	0.44	0.22	0	
	Total	12.18	6.59	0.21	0.27	0.16	0.05	
2017	Male	16.39	10.38	0.51	0.51	-	-	0.10
	Female	15.23	9.29	0.22	0.76			0
	Total	15.83	9.85	0.10	0.37			0.05
2018	Male	15.95	10.23	0.30	0.10	-	0.10	-
	Female	12.35	9.04	0	0.96		0	
	Total	14.20	9.65	0.15	0.52		0.05	
2019	Male	21.15	8.79	0.20	0.59	-	-	-
	Female	14.26	7.97	0.10	0.42			
	Total	17.81	8.39	0.15	0.51			
2020	Male	15.87	6.72	0.29	0.29	-	-	-
	Female	13.64	3.82	0.10	0.41			
	Total	11.78	5.31	0.20	0.35			
2021	Male	18.52	7.29	0.20	0.56	0	-	-
	Female	14.15	5.80	0.10	0.20	0.10		
	Total	16.40	6.57	0.15	0.40	0.06		
2022	Male	20.04	6.71	0.76	0.19	-	-	-
	Female	11.73	4.21	0.20	0.60			
	Total	16.01	5.49	0.49	0.39			

Table 3. Expected and observed suicides per month including Chi-square contributions

Month		Observed suicides	Expected suicides	Chi-square contributions
BS	AD			
Baishakh	Apr – May	386	366.25	0.86
Jestha	May – Jun	394	366.25	1.81
Ashad	Jun – July	390	366.25	1.29
Shrawan	July – Aug	450	366.25	18.19
Bhadra	Aug – Sept	400	366.25	2.75
Ashwin	Sept – Oct	382	366.25	0.52
Kartik	Oct – Nov	353	366.25	0.62
Mangsir	Nov – Dec	346	366.25	1.33
Poush	Dec – Jan	309	366.25	9.51
Magh	Jan – Feb	309	366.25	9.51
Falgun	Feb – Mar	332	366.25	3.55
Chaitra	Mar - Apr	367	366.25	0.004

a further breakdown by gender. The data provides a comprehensive view of how preferred suicide methods vary by age and gender. Hanging was the most preferred method across all age groups and both genders, although its proportion decreased with an increase in age. In the age group 0-14, it accounted for 80% of male and 92.3% of female suicides. In the adolescent and adult age groups (15-29), it accounted for 75.95% of male and 69.22% of female suicides. Continuing the decreasing trend of hanging with age, in the later extreme of the age group (60 and above), hanging accounted for 49.21% of males and 51.96% of females, which showed a significant decrease in the proportion of hanging in the later age group.

Contrary to the trend of hanging, self-poisoning became more common with an increase in age, particularly in the age groups 30-59 and 60 and above. In the age group 0-14, it accounted for 20% of male and 7.6% of female suicides, and in the later extreme of the age group (60 and above), it accounted for 48.82% of male and 44.11% of female suicides. Methods like falling, self-immolation, drowning, gunshot, and stabbing were less common but still present, with slight variations between age groups and genders.

Using a linear regression model, the study found that the rate of suicide by hanging in males increased by 0.682% per year ($p = 0.01$). For females, the rate decreased by 0.028% per year ($p = 0.90$). Overall, the total rate of suicides by hanging showed an increase of 0.273% per year ($p = 0.25$).

Similarly, in terms of suicide by self-poisoning, the rate in males decreased by 0.266% per year ($p = 0.21$). For females, the rate decreased by 0.289% per year ($p = 0.20$). Overall, the total rate of suicide by self-poisoning decreased by 0.200% per year ($p = 0.29$).

The analysis of suicide trends over the past decade (2013-2022) in Kathmandu has revealed important seasonal patterns that can inform public health interventions. The total number of observed suicides in Kathmandu was compared against expected suicides, assuming an equal distribution across all months. The expected number of suicides per month was calculated to be 366.25. The chi-square test was utilized to assess the significance of deviations between observed and expected suicides. Table 3 shows the summary of the data.

A total of 450 suicide cases were observed in Shrawan (July-August), which was significantly higher than expected, contributing 18.19 to the chi-square statistic ($p<0.01$).

Both Poush (December-January) and Magh (January-February) had observed suicides (309 cases each) significantly lower than expected, each contributing 9.51 to the chi-square statistic ($p<0.01$).

DISCUSSION

This study conducted a comprehensive analysis of suicide trends over a 10-year period (from 2013 to 2022) in autopsy examination data from the DoFM at MMC, Kathmandu, Nepal.

The overall suicide rate have increased slightly by 0.74% per year, which might indicate a relatively stable rate with minor fluctuations. The male suicide rate increased by 27.57%, while the female suicide rate decreased by 28.75%. This trend is consistent with various studies conducted throughout the world. In the US, the male suicide rate, particularly among Black and Asian youth, has been rising steadily, while the rates among females have decreased in some regions. The trend is also observed in other countries where male suicide rates are 3-4 times higher than female rates.[16] Our

finding of an increased rate of suicide in males and a decrease rate in females can be explained by several factors. In males, economic stress, societal expectations, and easy access to lethal means can be possible contributory factors for the increase in rate. However, in females, the decrease can be explained by improvements in women's education, changes in the societal role, effectiveness of the women empowerment strategies and programs.[17]

There is a significant difference in mean age at death between males and females (37.15 years for males vs. 30.94 years for females). This data is also consistent with the global trend of age at suicide, as females are more likely to attempt suicide at a younger age, whereas males tend to die by suicide later in life.[18,19] The spike of female suicides around the age of 18-20 and a sharp decrease thereafter may imply the suicide protective effect of marriage, as the age of marriage of females in our region concentrates around the same. The researches done prior to this also suggest the decreased suicidal tendencies in married women. Furthermore, Durkheim's foundational work in sociology highlighted that marriage can reduce suicidal risks in individuals as it provides stability and moral guidance[20–22].

Our study showed that hanging remains the most common method of suicide among both males and females, covering up almost 65% of male and 64% of female suicide. This finding aligns with the global trend, where hanging is the most preferred method due to its easy accessibility and lethality.[23]

In both males and females, the preference for hanging decreases with age and the preference for self-poisoning increases with age. Out of total suicides in the age group 0-14, 87.5% died by hanging, and 12.5% died by self-poisoning. In contrast, in the later extreme age group (60 and above), 50% died by hanging, 47.4% died by self-poisoning, and 2.6% died by other methods. A study in England also showed a similar result on hanging being used more in the young population.[24] Self-poisoning is more prevalent as age increases because of factors like chronic illness, depression, or more access to prescription medications in the later age group. Other less common methods were falls, self-immolation, drowning, and gunshots. Four gunshots and one stab injury had been reported, which were entirely done by males. Among suicidal gunshots, two of them were police while two were armies. Self-immolation, while less common overall, is more prevalent among females. This fact might highlight the importance of culturally sensitive suicide prevention strategies.

After analyzing the trends in suicide methods over time, the rate of suicide by hanging in males increased by 0.682% per year, while in females, it decreased slightly. These findings suggest that hanging remains a persistent method of suicide, with little change in its prevalence over the study period.

In contrast, the rate of suicide by self-poisoning decreased over time for both males and females. Globally, there has been a variable trend regarding self-poisoning as a method of suicide, depending on the geography and economy. A study conducted in 16 countries by Gunnell et al. showed a reduction in pesticide suicide and overall mortality after national bans on commonly ingested pesticides.[25] Public health interventions like the introduction of policies limiting access to large quantities of certain medications have major role in declining self-poisoning incidents.[26] The overall decrease in suicide rate by self-poisoning might indicate a positive impact of pesticide control and the control policy of medication distribution, however, there is a lot of room for improvement regarding the effectiveness of the control strategy.

The study's analysis of monthly suicide trends shows a notable difference in seasonal patterns. There is a statistically significant increase in suicides during the month of summer [Shrawan (July-August)] and a decrease during winter [Poush (December-January) and Magh (January-February)].

This spike during Shrawan could be attributed to various factors, such as seasonal affective disorder (SAD), financial stress related to the end of the fiscal year in Nepal, or cultural factors that increase stress during this time. The reduction in suicides during Poush and Magh could be related to the holiday season, which might bring a sense of community and support, or it could be due to colder weather reducing outdoor activities and interactions, potentially leading to fewer impulsive actions. A study in 2012 by Woo JM et al. showed that, in late spring and summer (April-May), the most common suicidal peak was found.[27] Whereas, studies in Scotland and Oxford revealed female suicide rates to be increased in summer and decreased in winter, while no significant seasonal variation was found in male.[28,29] Possibly, the interplay of various factors might play an important role in seasonal variation, and it needs to be researched further.

There are some limitations to the study. The prior researches say actual rate of suicide here is considerably higher and that many suicides are not reported, reason being stigma and myth of criminalization of attempted suicide.[30] The distribution of suicide methods may be influenced by differences in reporting accuracy. Violent methods, such as hanging, are likely to be reported more accurately than nonviolent methods like self-poisoning and drowning, potentially leading to underreporting of less violent suicides.[7,9] This discrepancy suggests that methods like pesticide poisoning might be more significant than the

data reflects. The absence of similar quantitative studies in Kathmandu or Nepal limited the ability to compare findings. Additionally, without exact population figures for different age groups, relying on percentage comparisons instead of incidence rates may not accurately reflect the risk across age categories.

CONCLUSION

Hanging was the most commonly used method across both genders and all age groups. The prevalence of hanging decreased with age, while self-poisoning became more common as age increased. Overall, male suicide had shown increased rates, while female rates had decreased. Suicide rates also showed seasonal fluctuations, with a peak in the summer months (July–August) and a drop in the winter (December–February).

Measures such as limiting access to lethal means, addressing the societal, cultural and economic factors contributing to suicide, and enhancing mental health services with more focused on high risk groups (younger females, mid-age and older males) are vital for suicide control and prevention. Additionally, the implementation of pesticide-control laws, rationale restrictions on over-the-counter drug availability, and focused intervention during at-risk seasons could significantly decrease suicide in the district.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

Study concept and design: GC, BS, BM, BY; Data collection, analysis and interpretation: BS, BM, BY, BB, AM; Manuscript preparation: GC, BS, BM, BY, BB, AM; All author read and approved the final manuscript.

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